

Public Service
Company of Colorado

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May 6, 1988
Fort St. Vrain
Unit No. 1
P-88152

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Docket No. 50-267

SUBJECT: Control Rod Drive (CRD) Rod
Position Indication Instrumentation

REFERENCE: (1) NRC Memorandum, Heitner to Calvo
(NRC), dated December 15, 1987
(G-87445)

(2) PSC letter, Warembourg to Calvo,
dated April 7, 1988 (P-88121)

Gentlemen:

As a followup to our site meeting of December 4, 1987 (Reference 1), Public Service Company of Colorado (PSC) is transmitting as Attachments 1 and 2 to this letter the Control Rod Drive (CRD) Rod Position Indication (RPI) Instrumentation evaluation. Also, based on commitments set forth in Reference 2, please find enclosed in Attachment 3, PSC's evaluation of the Control Rod Drive Motor (CRDM) service temperature projection which incorporates the results of the most recent core testing.

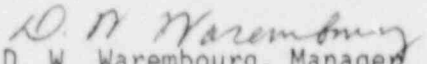
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If you have any questions on either of these subjects, please contact Mr. M. H. Holmes at (303) 480-6960.

Very truly yours,


D. W. Warembourg, Manager
Nuclear Engineering Division

DWW:CRB/dvd

Attachments

cc: Regional Administrator, Region IV
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Mr. Robert Farrell
Senior Resident Inspector
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ATTACHMENT 1
CRD ROD POSITION INDICATION INSTRUMENTATION

BACKGROUND

FSV Rod Position Indication (RPI) Instrumentation deficiencies were originally identified in Reference 1. In response to these NRC concerns, PSC performed an Integrated Systems Study and submitted recommended corrective actions in Reference 2 to resolve the CRD RPI concerns. In this response, PSC committed to the following actions: (1) replacement of the full-in/full-out limit switches with proximity limit switches; (2) replacement of the existing potentiometers with improved potentiometers which are appropriately designed and qualified for the life and service conditions to be experienced.

NRC's subsequent review of PSC's evaluation and proposed corrective actions (Reference 2) indicated that PSC's solutions were not adequately supported, resulting in a general misunderstanding between PSC and NRC.

To resolve the misunderstandings, PSC proposed (Reference 4) an onsite technical meeting to discuss the original NRC concerns. This meeting was conducted on December 4, 1987, and results of this meeting are reported in Reference 5. The purpose of this letter is to provide an updated PSC evaluation of CRD RPI Instrumentation.

DISCUSSION

The Integrated Systems Study for CRD RPI has been revised to resolve remaining concerns identified in the NRC Technical Evaluation Report (Reference 3) and has been included as Attachment 2 to this letter. PSC's resolution of specific NRC concerns identified in References 1 and 3 are contained in Enclosure 1 to Attachment 1.

CONCLUSIONS

Conclusions reached as a result of this revised study remain the same as those presented to the NRC in December, 1987. These conclusions are as follows:

- (1) CRD RPI Instrumentation (continuous and limit switch) currently installed at FSV is acceptable to meet operability requirements imposed by the FSAR and FSV Technical Specifications, when operated in accordance with current administrative limits. Improved maintenance and surveillance requirements support operational conditions.
- (2) PSC will continue to pursue the corrective actions identified below to further improve the reliability of CRD RPI Instrumentation.

PSC ACTIONS:

Short Term Corrective Actions Previously Implemented and Results:

The following practices have been implemented to improve overall reliability of the CRD RPI:

(1) Continuous Rod Position Indication (Potentiometers):

Imposition of administrative limits on operators (which prevent overdriving of the control rods past the full-in position) has resulted in NO potentiometer failures since the CRDM incidents of 1984; no additional short term actions are deemed to be necessary for these potentiometers pending implementation of long-term corrective action.

(2) Full-in/Full-out Limit Switches:

- (a) All full-in/full-out limit switches were replaced following the multiple limit switch failures in 1984;
- (b) As a result of improved maintenance, surveillance and operations practices, NO failures of full-in/full-out limit switches have been experienced since the CRDM incidents of 1984. Operator awareness of moisture ingress concerns and subsequent moisture reduction in the PCRV since 1984 have also contributed to the reduction in CRD RPI problems.

Long-Term Corrective Actions:

The following activities will be implemented as improvements intended to further improve CRD RPI reliability:

(1) Continuous Rod Position Indication (Potentiometers):

- (a) PSC will replace existing 10-turn dual element potentiometers with 15-turn dual element potentiometers, which will significantly reduce the possibility of breakage of the potentiometers due to overdriving the CRDM's. These new potentiometers will be procured to specifications which will ensure that the materials are suitable for the service conditions to which they will be exposed and will have suitable service life for their intended application. Appropriate quality standards will be applied to the procurement of these potentiometers to satisfy their design function.
- (b) Replacement of existing 10-turn dual element potentiometers with 15-turn dual element potentiometers will begin following completion of qualification analyses and type testing. This replacement is not expected to begin until after the 4th refueling and will be performed sequentially on CRDM's in the region being refueled during each subsequent refueling outage.

(2) Full-in/Full-out Limit Switches:

- (a) To reduce mechanical wear between the limit switch shaft and guide tube, reduced angle cams will be installed to actuate the limit switch shaft roller, per the manufacturer's recommendations. This replacement will be performed sequentially on CRDM's in the region being refueled during each subsequent refueling outage and is not expected to begin until after the 4th refueling.
- (b) Limit switches will continue to be replaced (like-for-like); replacement is intended to reduce the likelihood that mechanical wear or corrosion on the limit switch shaft will result in mechanical failure of the limit switch. Replacement of limit switches will be performed sequentially on CRDM's in the region being refueled during each refueling outage, commencing with the upcoming 4th refueling.
- (c) PSC will continue to evaluate design improvements or replacement indication which will improve the reliability of RPI full-in/full-out indication. Proximity switches which meet suitable quality and service requirements will be evaluated to determine if replacement is desirable.

References:

- (1) NRC letter, Denton to Walker, dated October 16, 1984 (G-84392)
- (2) PSC letter, Warembourg to Berkow, dated August 15, 1986 (P-86522)
- (3) NRC letter, Heitner to Williams, dated July 31, 1987 (G-87262)
- (4) PSC letter, Warembourg to Calvo, dated September 3, 1987
(P-87307)
- (5) NRC Memorandum, Heitner to Calvo (NRC), dated December 15, 1987
(G-87445)

ENCLOSURE 1

NRC ROD POSITION INDICATION CONCERNS

CONTROL ROD INSTRUMENTATION ANOMALIES:

(NRC Letter, Denton to Walker, dated 10/16/84 (G-84392))

Actions Prior to Restart (following 1984 CRDM incident):

1. To prevent CRDM damage and to protect rod position potentiometers and limit switches, plant procedures should be changed to prevent overdriving the CRDM past the full-in limit (yo-yo-ing).
2. Periodic surveillances of rod position potentiometers and switches should be developed and implemented in interim procedures and be proposed for inclusion in the plant technical specifications. This surveillance should include verification of limit switch operability and confirmation that redundancy has not been lost.

Long-Term Actions:

3. Damage due to overtravel should be precluded by installation of a positive mechanical stop or by providing sufficient clearance to prevent damage.

PSC RESPONSE:

Plant operating procedure SOP 12-01 has been implemented which provides precautions regarding the potential damage to the CRD RPI resulting from overdriving the control rod drives. Since the implementation of these administrative controls, there have been no failures of the potentiometer shafts. Additionally, heavy emphasis is placed on this issue during initial operator training and operator requalification training.

This concern has been addressed by compliance with Interim Technical Specifications 3.1.2 and 3.1.3, as implemented by supporting surveillances. Additional guidance is also contained in SOP 12-01 which directs operators to ensure that accurate and redundant RPI is available.

PSC intends to proceed with their long-term corrective action to replace the 10-turn dual element potentiometers with 15-turn dual element potentiometers. To resolve the overtravel as it relates to potentiometer damage, the installation of a mechanical stop was evaluated and determined to be not feasible.

4. An appropriate, independent and definitive means of verification of control rod full-in position should be provided because the installed rod position instrumentation can be inadequate to verify control rod position. In the present form, Watt-meter of the shim testing motor is considered inadequate to verify full insertion of control rods. It is therefore concluded that the Watt-meter method be refined or an alternate method be developed to achieve sufficient resolution of rod position and then formalized into a plant procedure.
5. Conduct an integrated systems study to resolve RPI maintenance and operability questions.

As reported to the NRC in PSC letter, Gahn to Johnson, dated 7/31/87 (P-85262), PSC has modified and strengthened the requirements specified in SOP 12-01. Surveillance Procedure SR-TE-9-X (Inserted Rod Position Indication) is specified to be used to accurately establish (wattmeter test) full-in rod position for control rod pairs with inoperable position indication per FSU Interim Technical Specifications.

The previous integrated systems study has been revised to incorporate comments received during the NRC onsite technical visit in December 1987.

CRDM ROD POSITION INDICATION INSTRUMENTATION TECHNICAL EVALUATION:
(NRC Letter, Heitner to Williams, dated 7/31/87 (G-87262))

1. The contribution of corrosion of the full-in limit switches was not evaluated.

Effects of corrosion and mechanical erosion have been evaluated in the revised integrated systems study. It has been determined that moisture ingress events which occurred during or before 1984 resulted in corrosion of metallic surfaces of the potentiometers and the limit switches. Increased operator awareness of the consequences and causes of moisture ingress into the core has resulted in significantly reduced core moisture levels, and therefore reduced corrosion. Erosion was also noted to be a problem with the limit switches due to the steep cam angle, thereby causing frictional forces to be present between the limit switch actuating shaft and the guide cylinder. Both erosion and corrosion concerns have been

2. The design of the replacement targets for the full-in/full-out limit switches did not consider the potential for damaging the rod position potentiometers when the control rods are overdriven.
 3. The failure of the slack cable limit switches was not evaluated.
 4. The specification for the replacement rod position potentiometers did not include all the environmental conditions that the components could be exposed to and did not define how the potentiometers would be qualified.
 5. The proposed replacement instruments that are important to safety (full-in limit switch and rod position potentiometer) did not comply with the quality
- reduced by the one-time replacement of all limit switches following the CRDM incident, and the continuing program of regional limit switch replacement during region refueling. Replacement of existing cam actuators with reduced angle cams will further reduce the likelihood of limit switch failure.
- As discussed during the December 1987 onsite technical meeting, there is not a credible mechanism for the replacement targets (or limit switch actuating cams) to mechanically interfere with the position potentiometer shaft.
- As discussed during the December 1987 onsite technical meeting and addressed in the discussion of limit switch failures in the revised integrated systems study, there have been no failures associated with the slack cable limit switches; activation of the slack cable limit switch during 1984 was proper indication of a failed CRDM cable.
- The specification for the replacement potentiometers has been prepared and incorporated into a PSC engineering evaluation to ensure that the replacement potentiometers will be suitably qualified for the service conditions and operating requirements that they are expected to experience. Qualification will include appropriate consideration of the temperature qualification plan previously provided to the NRC in PSC letter, Warembourg to Calvo, dated 4/7/88 (P-88121).
- As discussed during the December 1987 onsite technical meeting, the CRD RPI potentiometers and limit switches are non-safety related components.

standard and instrumentation requirements of GDC 1 and 13 of Appendix A to 10 CFR 50.

Therefore, requirements of GDC 1 and 13 are not directly applicable. PSC will take suitable precautions to ensure that replacement components will be manufactured and qualified to withstand the service conditions and operating requirements to which they will be exposed.

Attachment 1 to

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